

Consistency in mutualism relies on local, rather than wider community biodiversity

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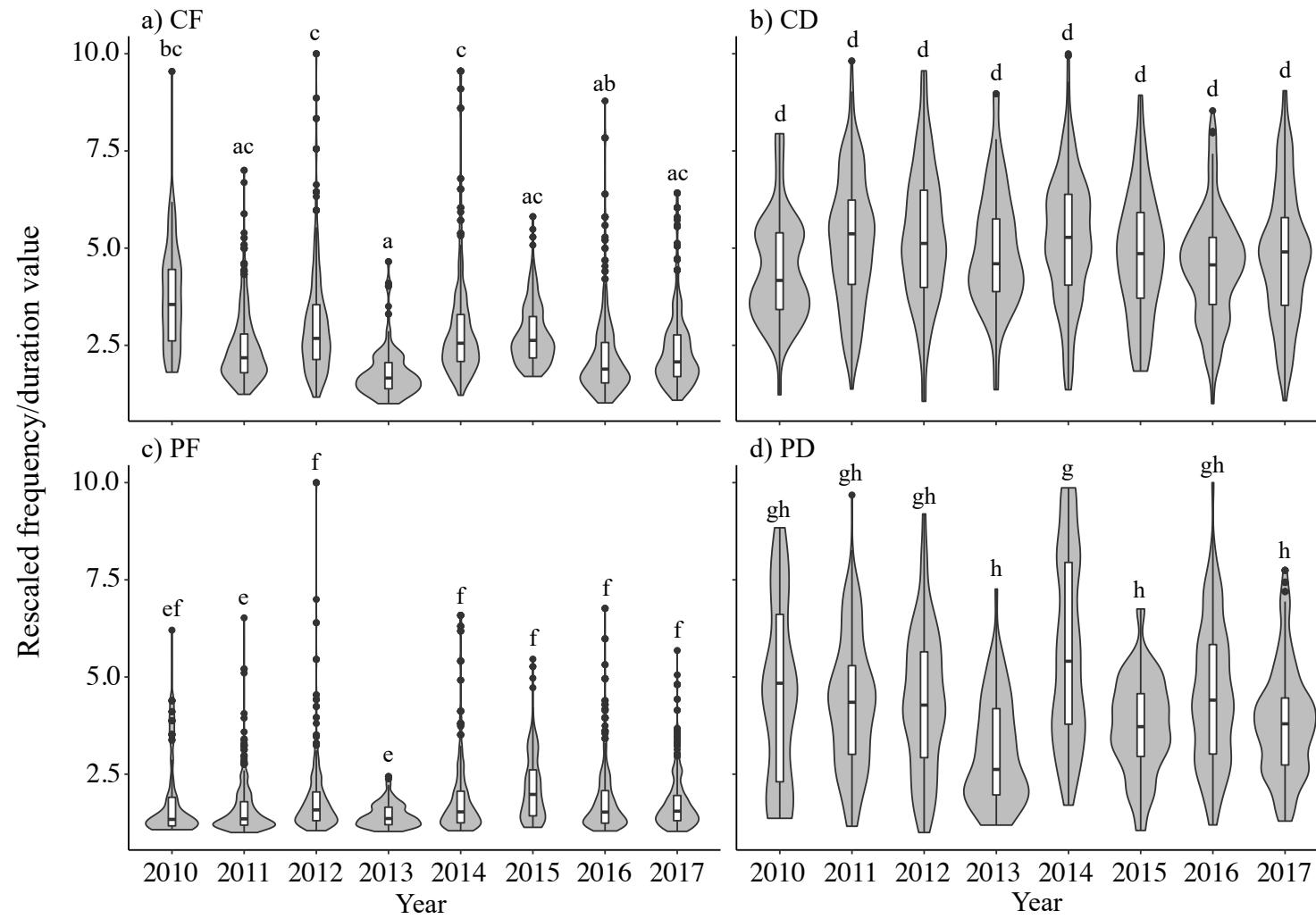
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SUPPLEMENTARY INFORMATION

Supplementary Table 1: GLMM model outputs determining whether cleaning and posing behaviours differed tempo-spatially.

| | Cleaning frequency | Cleaning duration | Posing frequency | Posing duration |
|-----------------------|-----------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Year | $\chi^2_7 = 34.42, p < 0.001$ | $\chi^2_7 = 11.17, p = 0.132$ | $\chi^2_7 = 78.51, p < 0.001$ | $\chi^2_7 = 22.89, p = 0.002$ |
| Year pattern | <i>See Supplementary Figure 1</i> | | | |
| Time of day | $\chi^2_1 = 0.07, p = 0.790$ | $\chi^2_1 = 0.05, p = 0.816$ | $\chi^2_1 = 0.96, p = 0.327$ | $\chi^2_1 = -0.018, p = 1.00$ |
| Station differences? | $\chi^2_1 = 22.65, p < 0.001$ | $\chi^2_1 = 25.09, p < 0.001$ | $\chi^2_1 = 25.09, p < 0.001$ | $\chi^2_1 = 0.37, p = 0.543$ |
| Spatial patterning? | $r = -0.030, p = 0.801$ | $r = 0.051, p = 0.151$ | $r = -0.005, p = 0.492$ | $r = 0.02, p = 0.262$ |
| Degree of aggregation | $r = -0.08, p = 0.501$ | $r = -0.06, p = 0.610$ | $r = 0.04, p = 0.697$ | $r = 0.01, p = 0.943$ |



Supplementary Figure 1: Sharknose goby (*Elacatinus evelynae*) cleaning frequencies (a – CF) and durations (b – CD) and their clients' posing frequencies (c – PF) and durations (d – PD) across 8 years. Predicted values from GLMMs are plotted, with the violin plots showing the distribution

of cleaning/posing frequency/duration values observed within each year (2010 – 2017), whilst box plots show median and inter-quartile ranges of predicted values. Letters indicate Tukey *post-hoc* groupings and identify significant differences between years. Predicted values have been rescaled from 1 – 10 to enhance figure clarity, with increased values representing increased frequencies/durations.

Supplementary Table 2: Significant GLMM predictors of sharknose goby (*Elacatinus evelynae*) cleaning frequencies and durations and their clients posing frequencies and durations across 8 years. Contextual factors are nested with the categories partner identity (PI), partner abundance (PA) and the presence of third-party species (TP).

| Cat | Factor | Cleaning | | Posing | |
|-----|-------------------------|------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|
| | | Frequency | Duration | Frequency | Duration |
| PI | Client functional group | $\chi^2_3 = 148.09$, p < 0.001 | $\chi^2_3 = 13.77$, p = 0.003 | $\chi^2_3 = 241.88$, p < 0.001 | $\chi^2_3 = 50.00$, p < 0.001 |
| | Client trophic level | $\chi^2_1 = 278.11$, p < 0.001 | - | $\chi^2_1 = 211.05$, p < 0.001 | $\chi^2_1 = 14.10$, p < 0.001 |
| | Client size | $\chi^2_1 = 8.18$, p = 0.004 | $\chi^2_1 = 21.44$, p < 0.001 | $\chi^2_1 = 13.46$, p < 0.001 | - |
| PA | Client local abundance | $\chi^2_1 = 214.00$, p < 0.001 | - | $\chi^2_1 = 99.27$, p < 0.001 | - |
| | Client wider abundance | - | $\chi^2_1 = 35.12$, p < 0.001 | $\chi^2_1 = 6.02$, p = 0.014 | - |
| | Cleaner local abundance | $\chi^2_1 = 4.38$, p = 0.036 | - | $\chi^2_1 = 6.58$, p = 0.010 | - |

| | | | | | |
|----|-------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|---|
| | Cleaner wider abundance | - | - | $\chi^2_1 = 10.50$, $p = 0.001$ | - |
| TP | Number species cleaned | $\chi^2_1 = 585.22$, $p < 0.001$ | - | $\chi^2_1 = 36.46$, $p < 0.001$ | - |
| | Number species locally available | $\chi^2_1 = 271.36$, $p < 0.001$ | - | - | - |
| | Client local relative abundance | $\chi^2_1 = 21.01$, $p < 0.001$ | - | $\chi^2_1 = 106.66$, $p < 0.001$ | - |
| | Number species in wider environment | $\chi^2_1 = 9.53$, $p = 0.002$ | $\chi^2_1 = 4.36$, $p = 0.037$ | - | - |
| | Abundance other cleaner species | $\chi^2_1 = 10.58$, $p = 0.001$ | - | $\chi^2_1 = 52.13$, $p < 0.001$ | - |

Supplementary Table 3: Within year significance of each of the significant long-term predictors of cleaning frequencies (a), durations (b) and posing frequencies (c) and durations (d). Significant years are shaded in grey. Some variables were quantified once per year and thus did not vary within years (indicated by ‘-’).

(a) Cleaning frequency

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------------|------------------------------------|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| Client functional group | $\chi^2_3 = 4.51$, $p = 0.212$ | $\chi^2_3 = 3.48$, $p = 0.323$ | $\chi^2_3 = 20.20$, $p < 0.001$ | $\chi^2_3 = 3.45$, $p = 0.327$ | $\chi^2_3 = 58.09$, $p < 0.001$ | $\chi^2_3 = 4.98$, $p = 0.174$ | $\chi^2_3 = 60.51$, $p < 0.001$ | $\chi^2_3 = 54.74$, $p < 0.001$ |

| | | | | | | | | |
|-------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Client trophic level | z = -2.10, p = 0.036 | z = -4.83, p < 0.001 | z = -6.26, p < 0.001 | z = -4.53, p < 0.001 | z = -6.62, p < 0.001 | z = -4.34, p < 0.001 | z = -6.92, p < 0.001 | z = -5.70, p < 0.001 |
| Client size | z = -0.98, p = 0.327 | z = -0.92, p = 0.356 | z = -0.89, p = 0.373 | z = 0.26, p = 0.798 | z = 3.02, p = 0.002 | z = 0.42, p = 0.674 | z = 1.39, p = 0.164 | z = 6.37, p < 0.001 |
| Client local abundance | z = 3.54, p < 0.001 | z = 2.16, p = 0.031 | z = 7.56, p < 0.001 | z = 0.56, p = 0.577 | z = 7.16, p < 0.001 | z = 4.04, p < 0.001 | z = 7.39, p < 0.001 | z = 1.76, p = 0.079 |
| Client local abundance | z = -1.15, p = 0.249 | z = -1.34, p = 0.179 | z = 0.69, p = 0.488 | z = -0.64, p = 0.523 | z = -0.73, p = 0.463 | z = 0.99, p = 0.323 | z = -1.10, p = 0.270 | z = -2.28, p = 0.023 |
| Number species cleaned | z = 3.16, p = 0.002 | z = 6.65, p < 0.001 | z = 9.69, p < 0.001 | z = 7.36, p < 0.001 | z = 8.75, p < 0.001 | z = 7.66, p < 0.001 | z = 13.56, p < 0.001 | z = 12.63, p < 0.001 |
| Number species locally available | z = -3.20, p = 0.001 | z = -5.57, p < 0.001 | z = -5.30, p < 0.001 | z = -3.04, p = 0.002 | z = -5.04, p < 0.001 | z = -5.46, p < 0.001 | z = -7.39, p < 0.001 | z = -3.53, p < 0.001 |
| Client local relative abundance | z = -4.63, p < 0.001 | z = -5.11, p < 0.001 | z = -2.38, p = 0.017 | z = -0.68, p = 0.498 | z = 0.93, p = 0.354 | z = -1.96, p = 0.050 | z = -0.91, p = 0.362 | z = 2.22, p = 0.027 |
| Number species in wider environment | - | | | | | | | |
| Abundance other cleaner species | - | | | | | | | |

(b) Cleaning duration

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Client functional group | $\chi^2_3 = 11.97$, p = 0.007 | $\chi^2_3 = 21.68$, p < 0.001 | $\chi^2_3 = 3.44$, p = 0.328 | $\chi^2_3 = 4.92$, p = 0.177 | $\chi^2_3 = 11.55$, p = 0.009 | $\chi^2_3 = 5.42$, p = 0.144 | $\chi^2_3 = 1.85$, p = 0.605 | $\chi^2_3 = 1.94$, p = 0.585 |
| Client size | t = 0.90, p = 0.365 | t = 0.85, p = 0.395 | t = 4.57, p < 0.001 | t = 2.17, p = 0.030 | t = 0.58, p = 0.562 | t = 1.47, p = 0.141 | t = 1.83, p = 0.067 | t = 0.56, p = 0.578 |
| Client wider abundance | t = 0.40, p = 0.690 | t = -4.25, p < 0.001 | t = -2.40, p = 0.017 | t = -1.44, p = 0.149 | t = -2.18, p = 0.029 | t = -0.98, p = 0.326 | t = -0.30, p = 0.763 | t = -0.68, p = 0.495 |
| Number species in wider environment | - | | | | | | | |

(c) Posing frequency

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| Client functional group | $\chi^2_3 = 5.62$, p = 0.131 | $\chi^2_3 = 19.72$, p < 0.001 | $\chi^2_3 = 15.61$, p = 0.001 | $\chi^2_3 = 15.48$, p = 0.001 | $\chi^2_3 = 128.13$, p < 0.001 | $\chi^2_3 = 6.37$, p = 0.095 | $\chi^2_3 = 35.02$, p < 0.001 | $\chi^2_3 = 39.52$, p < 0.001 |
| Client trophic level | z = -2.16, p = 0.031 | z = -4.03, p < 0.001 | z = -1.85, p = 0.065 | z = -4.20, p < 0.001 | z = -6.69, p < 0.001 | z = -4.09, p < 0.001 | z = -5.75, p < 0.001 | z = -5.55, p < 0.001 |
| Client size | z = -2.04, p = 0.041 | z = -3.13, p = 0.002 | z = -1.60, p = 0.111 | z = 0.18, p = 0.857 | z = 0.17, p = 0.863 | z = -2.16, p = 0.031 | z = -2.23, p = 0.026 | z = 0.81, p = 0.418 |

| | | | | | | | | |
|---------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Client local abundance | $z = 1.51$, $p = 0.130$ | $z = -1.89$, $p = 0.059$ | $z = 0.75$, $p = 0.454$ | $z = 0.73$, $p = 0.463$ | $z = 1.96$, $p = 0.050$ | $z = -2.77$, $p = 0.006$ | $z = 4.54$, $p < 0.001$ | $z = 5.54$, $p < 0.001$ |
| Client wider abundance | $z = -1.39$, $p = 0.165$ | $z = 3.48$, $p < 0.001$ | $z = 3.59$, $p < 0.001$ | $z = 0.74$, $p = 0.462$ | $z = -0.66$, $p = 0.511$ | $z = -0.25$, $p = 0.801$ | $z = 3.79$, $p < 0.001$ | $z = 1.51$, $p = 0.132$ |
| Cleaner local abundance | $z = 0.22$, $p = 0.829$ | $z = 0.10$, $p = 0.917$ | $z = 0.29$, $p = 0.769$ | $z = -1.25$, $p = 0.211$ | $z = -1.04$, $p = 0.299$ | $z = 0.18$, $p = 0.860$ | $z = -2.96$, $p = 0.003$ | $z = -1.63$, $p = 0.103$ |
| Cleaner wider abundance | - | | | | | | | |
| Number species cleaned | $z = 0.56$, $p = 0.579$ | $z = -0.63$, $p = 0.528$ | $z = 2.48$, $p = 0.013$ | $z = 2.66$, $p = 0.008$ | $z = 2.74$, $p = 0.006$ | $z = 0.64$, $p = 0.519$ | $z = 3.37$, $p < 0.001$ | $z = 2.73$, $p = 0.006$ |
| Client local relative abundance | $z = -2.19$, $p = 0.029$ | $z = -2.38$, $p = 0.017$ | $z = -2.65$, $p = 0.008$ | $z = -3.11$, $p = 0.002$ | $z = -6.33$, $p < 0.001$ | $z = -2.19$, $p = 0.029$ | $z = -1.37$, $p = 0.172$ | $z = -3.54$, $p < 0.001$ |
| Abundance other cleaner species | - | | | | | | | |

(d) Posing duration

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------------|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Client functional group | $\chi^2_3 = 2.02$, $p = 0.364$ | $\chi^2_3 = 18.23$, $p < 0.001$ | $\chi^2_3 = 3.86$, $p = 0.277$ | $\chi^2_3 = 11.93$, $p = 0.008$ | $\chi^2_3 = 26.41$, $p < 0.001$ | $\chi^2_3 = 3.80$, $p = 0.284$ | $\chi^2_3 = 0.87$, $p = 0.832$ | $\chi^2_3 = 6.10$, $p = 0.107$ |
| Client trophic level | $t = 0.22$, $p = 0.824$ | $t = 1.36$, $p = 0.175$ | $t = 2.76$, $p = 0.006$ | $t = 1.05$, $p = 0.293$ | $t = 1.51$, $p = 0.131$ | $t = 1.54$, $p = 0.124$ | $t = 0.25$, $p = 0.803$ | $t = 0.09$, $p = 0.926$ |